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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,425,811, on April 17, 2003, by ARNIE B. WALLIN, for "Modular Wall System with
Footing Form".

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Abstract

A precast panel has forms mounted thereon for forming post-like flanges and a footing. Upon erection of on array of panels the flanges and footing may all be cast on-site, with appropriate reinforcing/coupling means present within the form core volumes by filling such forms with binder material such as concrete. Optionally, an upper "sill/beam" may also be formed in a similar manner, the precast panel being provided with a sill/beam form attached to the wall portion of the panel.

Title: MODULAR WALL SYSTEM WITH FOOTING FORM

Field of the Invention

5 This invention relates to the construction industry. More particularly it addresses a modular wall system based upon precast concrete panels and accessory elements that may be erected on a site to provide a wall suitable for a building.

Background to the Invention

10 Construction techniques based upon the use of precast panels for forming walls are known. This includes panels which are tipped-up for positioning on a pre-installed foundation and then fastened together by various means.

15 In the building construction business it is often necessary to install footings in the ground that extend below the frost line. A "Frost wall" is intended to provide a load-bearing support for aboveground walls for one or two-story buildings that are constructed without any basement.

20 In one form of construction a Frost Wall is formed by pouring concrete into a narrow three or four foot deep trench onto a bedding of compacted gravel. In this procedure, both a concrete footing and the wall are formed simultaneously. While forms may be used to contain such a
25 poured concrete wall, such forms may be omitted to save the cost of their erection and removal. But omission of such forms is at the expensive of consuming larger, unnecessary, volumes of concrete.

30 A number of prior art references that describe the
use of precast concrete wall panels are referred-to in U.S.
Patents No's 5,864,999 and 6,244,005, the contents of which
are adopted herein by reference. These latter references
describe a precast wall panel with rearwardly extending
35 flange portions that have reinforcing members protruding
downward for embedment in a linear, pre-cast footing member
having a U-shaped trough that is eventually filled with
concrete grout.

The casting of footings on-site in conjunction
with the simultaneous casting of vertical members is
40 addressed in a number of prior art references. US Patents
5,367,845; 5,922,236 and 6,332,599 all contemplate the
simultaneous filling of a wall form and a footing form to
produce a continuous wall overlaying a footing. US Patents
4,830,543 and 5,785,459 as well as application US
45 2002/0079424 A-1 refer to the simultaneous formation of a
post over a footing wherein the forms for an interconnected
footing and post are left in place after the concrete grout
has been poured and set.

50 In both of these classes of systems no reliance is
placed on the use of preformed wall panels to reduce the
amount of concrete to be poured on site, and to serve as a
support to guide in the pre-alignment of forms.

55 The first above two referenced U.S. patents
describe a system for installing a partially prefabricated
wall below ground. According to the design of one of these
two prior art systems, precast concrete panels are fitted
with hollow forms which allow "beams" and "posts" to be cast

on-site, after the panels have been erected on precast footings to form continuous walls. Conceptually, this is the reverse of classic beam and post construction wherein the walls are added as in-fill after the beams and posts are erected.

According to this latter prior art system the precast panels are installed with their hollow flange forms extending across the precast concrete footings; overlying the footing trough that is to be filled with grout. This grout forms a continuous connection with grout used to fill the sheet metal flange forms used to create the "posts". Preferably, the grout contains reinforcing bar that has been pre-wired into positioned both within the flange forms and within the footing trough.

A complication of this prior art system is that it premises the separate installation of a concrete footing that is either precast or has previously cast in place. The following invention addresses a system that avoids such complications.

The invention in its general form will first be described, and then its implementation in terms of specific embodiments will be detailed with reference to the drawings following hereafter. These embodiments are intended to demonstrate the principle of the invention, and the manner of its implementation. The invention in its broadest and more specific forms will then be further described, and defined, in each of the individual claims which conclude this Specification.

Summary of the Invention

90 The invention according to one aspect relies upon the presence of hollow forms coupled to a precast wall panel for subsequent filling with a binder material such as concrete. These forms produce both a vertical flange on the panel, once the open hollow interior of the form is filled with the binder material, and a footing. The flange on the wall panel may then function as a post to support a top-side horizontal beam.

95 Accordingly a precast concrete panel, which serves as a wall, may fitted with a sheeting material which provides one or more vertical flange forms for creating one or more flanges on the wall panel when filled with concrete. The panel is also provided with sheeting material to define a footing form extending along the base of the wall. This footing form serves to contain concrete poured into the footing form through the vertical flange form(s). This panel, so fitted, is installed in a prepared trench, preferably on top of a prepared base, such as a consolidated bed of gravel, crushed stone or the like.

100 With the base leveled to a true height, several panels according to the invention may be placed in line along the base. To keep the panels in line, short wooden props extending to the adjacent soil may be used and/or the panels may be partially backfilled. As a further alternative for maintaining alignment, straightening brackets in the form of lengths of 2X4 lumber may be clamped along the upper edge of the panels.

115 Concrete "grout" is then poured into the upper
exposed ends of the vertical forms to serve as a fill or
binder. The concrete is mixed to a flowable consistency,
optionally with additives to maintain flowability. After
120 concrete has been poured into the vertical forms, vibrators
may be applied to the forms to remove air pockets and
encourage flow.

The concrete poured into the vertical forms
descends into the void within the footing form and spreads-
out within such void along the base of the panel until the
125 concrete flows to the base of the next vertical form. By
progressively filling the vertical form, the footing forms
can be filled with a continuous volume of concrete that
serves as the footing for the wall. Such wall also now
contains vertical, concrete-filled flanges which serve as
130 posts as well as a concrete-filled footing. The concrete
or binder within the footing and flanges is integrally
connected.

Preferably, coupling means such as reinforcing
bar is present within the hollow interiors of the hollow
135 flange form, such coupling means protruding downwardly from
the lower end of each of the hollow flange forms to connect
with binder and/or coupling means present within the
interior of the hollow footing form. Such coupling means
becomes cast in place when the respective hollow interiors
140 are filled with binder material.

Alternately or additionally, portions of coupling
means connected to the outer sheeting material or surface
walls of the forms may extend into the binder to serve with

such form walls as coupling means and provide reinforcement for the binder.

A panel may have a single flange form or two or more hollow flange forms for casting multiple flanged portions positioned. Thus a preferred form of panel of "F"-shaped cross-section may be provided. Further, flange forms at the ends of the panel may be half-forms of the type described in U.S. Patent 6,244,005

The panel of the invention may also, preferably, be provided with a sheeting material defining a form mounted along its upper edge to serve as an upper trough for receiving concrete at the same time that the vertical and footing forms are being filled. With concrete/binder cast in this upper trough an upper horizontal tie beam or sill beam is formed along the top edge of the wall panel. Reinforcing bar or other coupling means may be laid in this trough before it is filled with concrete. This reinforcing bar is preferably connected to reinforcing bar or coupling means placed in the vertical and footing forms to become embedded therein once these forms are filled. With such upper trough coupling means extending for the length of encircling walls, as for a basement frost wall or foundation wall, such walls are effectively "belted" or tied in place. The upper beam cast in the trough then qualifies as a tie beam.

The invention in another aspect is directed to a modular panel system comprising a plurality of panels wherein each panel comprises:

(a) a wall portion and one or more hollow flange forms each having a hollow interior and being mounted on such wall portion for casting one or more outwardly extending flanges on said wall portion; and

(b) a hollow footing form for forming a footing, the interior of the hollow footing form communicating with the interior of the hollow flange form

wherein the panels are dimensioned to be joined end to end to provide a continuous wall of extended length.

Preferably, the material for the flange and footing forms are of sheet material, e.g. galvanized steel or plastic which is fastened along one edge of the sheet material, as by embedment or through fasteners, to the precast wall portion. To improve coupling between these forms and the binder with which such forms are eventually to be filled without precipitating fracturing of the panel material, portions of the side walls of the flange forms may be depressed or deformed inwardly to provide dimples or tabs to be embedded within the binder when the binder is poured into the forms.

As stated earlier an upper horizontal, tie beam or sill (referenced as a "lintel" member in the cited prior art) member may be provided, positioned along the tops of each panel, overlying the wall and flanged portions. Such a sill/beam member can be provided by having a sill/beam trough form fitted to the wall along its upper edge defining an upper trough volume which may be filled with binder, e.g. concrete. Adjacent trough form may be joined

so that a continuous cast-in-place sill/beam may be created spanning the tops of the precast panels.

205 Upper trough reinforcing means may be present in the upper trough volume, preferably connected to upper coupling means associated with the flange forms and extending continuously through the trough volumes of adjacent panels. Such upper coupling means are then imbedded in the binder that is placed in the sill/beam trough at the same time that the hollow flange form(s) are
210 filled with binder.

Additionally or alternately, reinforcing/couple means may extend from the pre cast wall portion into the trough volume. This may be in the form of reinforcing bar embedded in the wall portion and extending horizontally or
215 at an angle into the trough volume. Such reinforcing bar may also serve as lifting loops during installation of the wall panels.

220 Similarly, coupling means such as reinforcing bar of flange form portions may extend from the bottom of the wall portion of each panel into the footing volume defined by the footing forms. Again, as for the sill/beam trough, embedded reinforcing may extend along and through the footing volume, preferably spanning the juncture between
225 adjacent panels.

The sheeting material of the footing forms is seated with its wall-mounted edge extending along the side of the wall portion near the bottom end of each panel. The sheeting material of the footing forms may then extend

230 outwardly away from the wall and downwardly to define an
enclosed footing volume, for overlying a supporting
foundation base. This sheeting material may proceed
directly downward from the wall panel to its terminal edge
or may form a bend between these two limits. To ensure
235 firm engagement of the outer edge of the sheeting material
with the base, such material may be resiliently elastic,
with the lower edge of the other boundary of the sheeting
material for the footing form extending below the lower
edge of the wall portion in its relaxed state before the
240 panel is placed upon the base. When placed on a
horizontal, flat base such lower edge will then be
deflected upwardly into alignment with the lower edge of
the wall, while bearing resiliently, with a downward
pressure, against the base. Spikes or the like may
245 optionally be used to further anchor the outer end of the
footing form to the base.

The foregoing summarizes the principal features
of the invention and some of its optional aspects. The
invention may be further understood by the description of
250 the preferred embodiments, in conjunction with the
drawings, which now follow.

Summary of the Figures

255 Figure 1 is a face view of the side of a prior
art panel with sill/beam trough and flange forms.

Figure 2 is an upwardly directed, cross-sectional
end view of the panel Figure 1.

Figure 3 is a side edge view of the panel of Figure 1.

260 Figure 4 is a partially cut away side view of the panel of Figure 1 installed on a pre-cast footing with grout/filler in place in the sill/beam and flange forms and within the footing trough.

265 Figure 5 is a side face view of a wall panel according to the invention with flange and footing forms present and including a preferred but optional sill/beam form.

Figure 6 is an edge view of the panel of Figure 5.

270 Figure 7 is a pictorial view of a wall structure formed of multiple panels as in Figure 5.

Figure 8 is a pictorial detail view of the juncture of abutting panels having edge flange form means as in Figure 7 and footing forms as in Figure 5.

275 Figure 7 is a top, cross-sectional view through the wall panel downwardly-directed of Figure 5.

Figure 8 is a cross-sectional end view of the lower portion of one variant of the footing trough anchored to a base.

280 Figure 9 is a cross-sectional end view of the upper trough and wall panel portion showing reinforcing bar.

285 Figure 10 is a cross-sectional side view of a n erected wall based on the wall panel of Figure 5 installed in site.

Description of the Preferred Embodiment

Figures 1, 2 and 3 show a prior art panel as depicted in US patent 6,244,005 with two hollow flange forms 30. The forms 30 are of a sheet material, such as galvanized sheet steel, bent to a "U"-shaped cross-section with the legs 36 of the "U" embedded in the panel 1 at the time of casting the panel 1. Each flange form 30 has a hollow core 31 which serves as a flange volume.

A sill/beam trough form 32 may also be cast into the panel 1, spanning between the flange forms 30. The interiors 31 of the flange forms 30 communicate with the volume 33 of the trough formed by the sill/beam trough form 32.

On assembly as a wall panel, reinforcing bar 7, 8 which serve as upper and lower coupling means may be inserted into the interior volumes of the flange form cores 31, protruding to respectively lie within the sill/beam trough volume 33 and to extend downwardly below the panel to engage with a footing. Sill/beam horizontal reinforcing bars 24 may be placed in the sill/beam trough and optionally tied to the reinforcing coupling bar 7. In lieu of bar inserted into the flange interior 31, a portion 38 of the flange form 30 itself may protrude into the trough volume for engagement with the sill/beam and/or footing which is to be formed alternately, an anchoring plate may be bolted to the form 30 to protrude in a similar manner.

To couple the wall panel 1 more securely to the sill/beam to be formed in the trough 33, reinforcing 40 may be embedded in the wall 1 next to the trough interior 33.

This may be in the shape of expanded metal plates located at intervals along the top portion of the panel 1 preferably intermediate the forms 30. As well, upwardly extending handling hooks (not shown) of heavy gauge wire or rod may also be embedded in the upper end of the wall panel 1 to provide lifting attachments and serve as supplemental reinforcing.

The walls of the flange forms 30 may have bent tabs 35 punched inwardly into the flange core 31. These tabs 35 become embedded in the cement or binder material to be used as binder when the flange cores 30 and sill/beam trough volumes 33 are filled. This increases the coupling between the form 30 and the binding filler, increasing their composite strength.

In Figure 4 the prior art panel of Figure 1 is shown mounted on a precast footing assembly 9, 21 over a base 22. A trough 11 in the footing members receives reinforcing bar 24 from a flange form 30. Both the footing trough 11 and sill beam trough volume 33 are filled with concrete 39. Earth 28 has been back-filled against the wall panel 1.

Figures 5 and 6 show an improved prefabricated wall panel 50 in accordance with the invention. The wall panel 50 has a wall portion 51, preferably of concrete, fitted with sheeting material 65, preferably galvanized steel, to constitute a central vertical flange form 52 that will provide a flange or post on the wall portion 51 when filled with concrete. This flange form 52 has an inner

flange form volume 53. Outer forms 30A are in half-form
format.

At the base of the wall portion 51, sheeting material is coupled to the side surface of the wall portion 51 to provide a footing form 54. This footing form 54 has an interior footing form volume 55 and is preferably open in the downwardly directed direction. The flange form volume 53 and footing form volume 55 are interconnected to permit such volumes 53, 55 to be filled with a continuous quantity of binder material.

Wall panels 50 are assembled on a base 22 with the vertical edges 58 of the wall portions 51 abutting to produce a continuous wall structure. The footing forms 54 of each individual wall panel 50 extend horizontally to be interconnected to each other. Thus the interconnected footing forms 54 provide continuously interconnected footing form volumes 55.

The base 22 is preferably of compacted aggregate or such other material as is required to provide a stable support for the footing that is to be cast within the footing form 54.

Optionally, but preferably sheet material is coupled to the side surface of the wall portion 51 near its upper edge to provide a sill/beam form 61. This sill/beam form 61 is open in the upwardly directed direction and defines a sill/beam form volume 62.

This sill/beam form volume 62 is interconnected with the flange form volume 53 to permit such volumes 53,

62 to be filled with a continuous quantity of binder material, providing a "funnel" action during the pour.

375 When assembled to provide a continuous wall structure, the sill/beam forms 61 of each individual wall panel 50 extend horizontally to be interconnected to each other. The sill beam forms 61 may overlap and be connected by sheet metal screws. The interconnected sill/beam forms 61 thereby provide continuously interconnected sill/beam 380 form volumes 62 for filling with a continuous volume of binder material 56.

385 Reinforcing means such as rod 64 may be laid in any or all of these form volumes 53, 55, 62. Preferably such rod is interconnected respectively along the lengths of the sill/beam form volumes 55 and footing form volumes 62. Further, optionally but preferably, reinforcing rod 64 within the flange form volume 53 may be connected to rod 64 in either the footing form volume 62, or sill/beam volume 55, or both. The rod 64 in the flange form volume 53 need 390 not extend all the way between the rod 64 in the respective sill/beam and footing form volumes 62, 55. It is sufficient, when employed, for rod 64 in the flange form 52 to extend only partially into the flange form volume 53.

395 The surface of the footing form 54 has an outer edge 68 which is directed downwardly to bear against the base 22 on which the wall panels 50 are positioned as shown in two variants in Figures 6 and 8. The sheeting material of the footing form 54 is preferably made of an elastically 400 resilient material. The outer edge 68 may be constructed,

as shown in Figure 6 to underlie the bottom edge 69 of the wall portion 51 when the wall panel is freely suspended. By this means the outer edge 68 may be caused to bear with a resilient force against the base 22 when installed in position, reducing the tendency for the edge 68 to lift when the footing form volume 55 is being filled with binder material. Spikes 73 may supplement the attachment of the outer edge 67 to the base 22, as shown in Figure 8.

The wall panel 50 may be provided with embedded loops along its bottom, Figure 8, and top, Figure 9, edges 69, 70. Protruding from ends embedded into the wall portion 51, rods 72 may serve both as lifting loops and, when bent down, as coupling means between the wall portion 51 and grout that will fill the respective forms 61, 54. Such rod 72 may optionally be coupled to reinforcing rod 64 present in the sill/beam and footing form volumes 62, 55. A further end 71 of such rod 72 may protrude from the wall panel 50 into the trough volume 55 to serve as a guide when the rod 72 is being cast in place and to couple the sill beam to the walls 51.

In embedding sheet material edges in concrete it is preferable to interrupt the straight run of the edge with indentation and/or deflection to avoid formation of a path which will serve as a focus for the creation of cracks in the concrete. Thus the form edges as shown in Figures 5, 8 and 9 are interrupted by bent tabs 74.

By casting both the flanges which serve as posts and footing on site in one operation, costs are reduced. Because key parts are precast and incorporate pre-affixed

430 forms, no forms need be created on-site. Further, by being
fastened to precast panels, the forms are precisely placed
in the exact locations where flanges and the footing should
be eventually installed. This greatly facilitates the
erection process.

435 Although suited for basement and above ground
walls, the invention is particularly suited for use as a
Frost Wall.

Conclusion

440 The foregoing has constituted a description of
specific embodiments showing how the invention may be
applied and put into use. These embodiments are only
exemplary. The invention in its broadest, and more
specific aspects, is further described and defined in the
445 claims which now follow.

These claims, and the language used therein, are
to be understood in terms of the variants of the invention
which have been described. They are not to be restricted
to such variants, but are to be read as covering the full
450 scope of the invention as is implicit within the invention
and the disclosure that has been provided herein.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY IS CLAIMED AS FOLLOWS:

1. A preformed wall panel, comprising:

a) a wall portion fitted with a vertical flange form
with an interior flange volume for creating a flange on
the wall portion when filled with binder material; and

b) a footing form fitted along and proximate to the
base of the wall portion to provide a downwardly open
footing volume,

wherein said vertical flange form and footing form define
an interconnected volume and wherein said forms serve to
contain binder material poured into the footing form
through the vertical flange form to provide said wall
portion with both a flange and a footing.

2. A preformed wall panel as in claim 1 comprising a
trough form mounted along the upper edge of the wall
portion defining a trough volume that communicates with
said flange volume for receiving concrete at the same time
that the flange form and footing form are being filled with
binder material.

3. A building wall comprising a plurality of panels as in
claim 1 mounted on a base surface wherein the footing forms
of the respective panels are aligned to provide with said
base surface a series of continuous footing volumes
extending between consecutive footing forms of each panel
whereby the footing forms can be filled with a continuous

which communicates with the interior flange
volume of the flange form

wherein both interior volumes are interconnected so as to
permit them to be filled with a continuous quantity of
binder material.

8. A system as in claim 7 comprising footing coupling
means protruding downwardly from the lower end of the
flange form into the footing volume whereby such footing
coupling means will be cast in place within the footing
volume when the respective flange and footing volumes are
filled with binder means.

9. A system as in claim 8 wherein the footing volume
contains reinforcing means and the footing coupling means
connects with said footing reinforcing means present within
the footing volume.

10. A system as in claim 7, said panels each comprising an
upper sill/beam trough form fitted to the panel wall
portion along its upper edge defining an upper trough
volume that communicates with the flange volume whereby
said volumes may be filled with a continuous quantity of
binder material.

11. A system as in claim 10 comprising coupling means
protruding upwardly from the upper end of the flange form
into the trough volume to be imbedded in the binder that is

540 to be placed in the trough volume at the same time that the
flange form is filled with binder.

12. A wall system as in claim 8 wherein the coupling
545 means comprises steel of reinforcing bar extending into the
interior of the flange form.

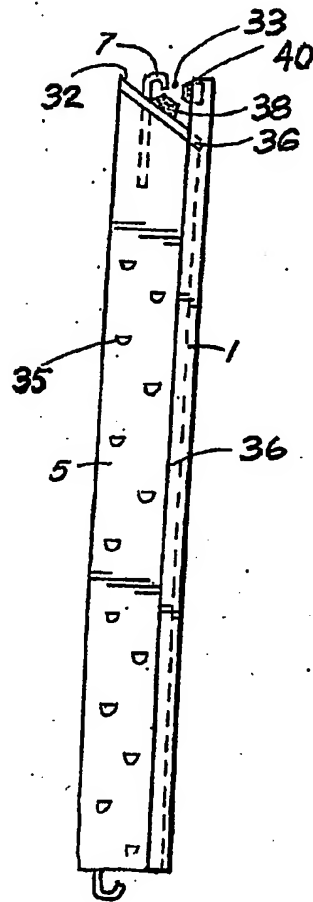
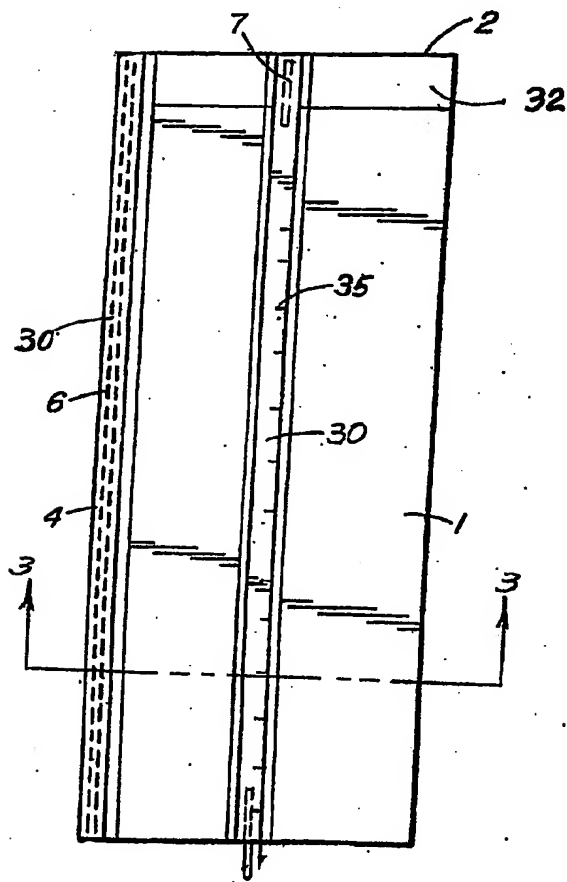
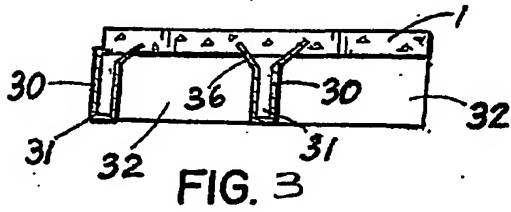
13. A wall system as in claim 12 wherein said bar is
coupled to steel reinforcing bar laid in the footing form
550 before it is filled with binder.

14. A system as in claim 7 wherein the material for the
flange and footing forms is of sheet material which is
fastened by embedment to the panel wall portion.

15. A system as in claim 14 wherein the forms are
555 provided by a sheet material comprising a sheet metal.

16. A wall system as in claim 7 wherein said flange
form is constituted by half-form means mounted on said wall
560 panels, the half-form means being positioned at wall panel
edges to abut against a corresponding half-form means on an
adjacent panel and define said flange form volume.

565



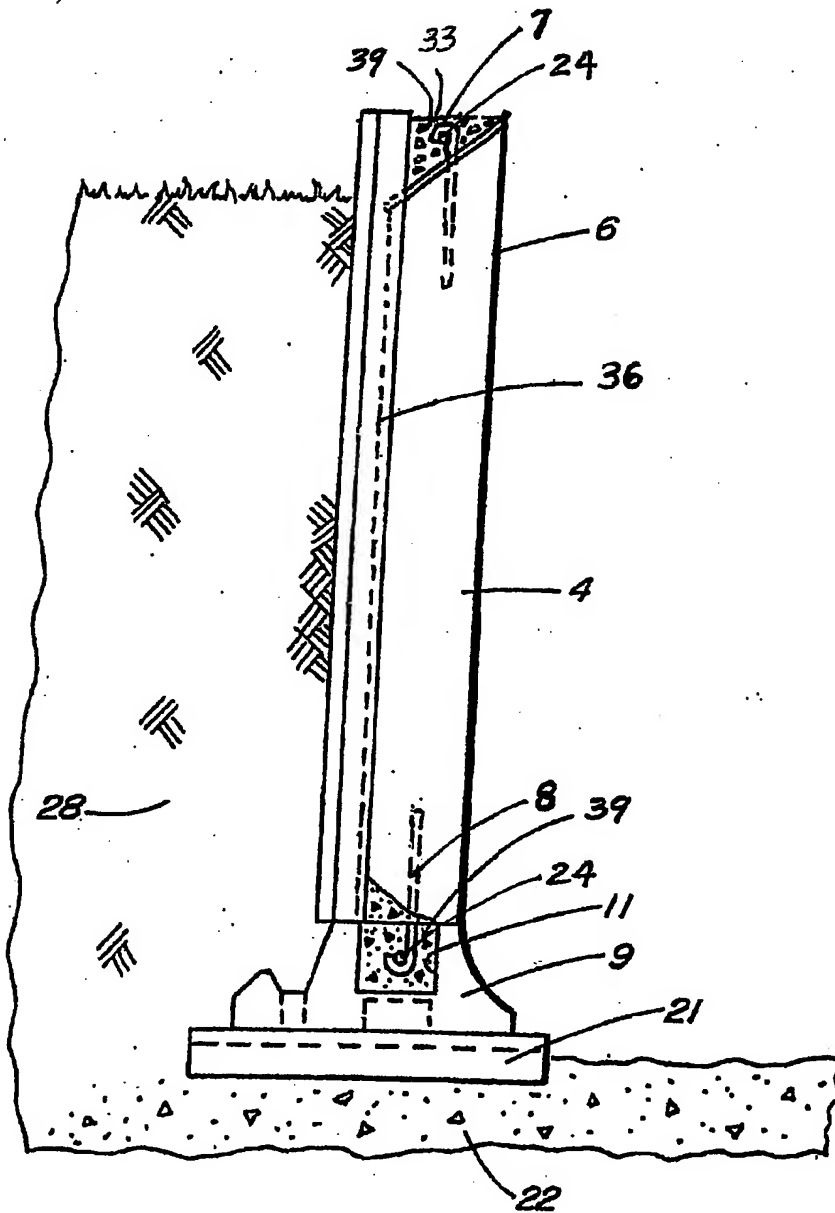


FIG. 4

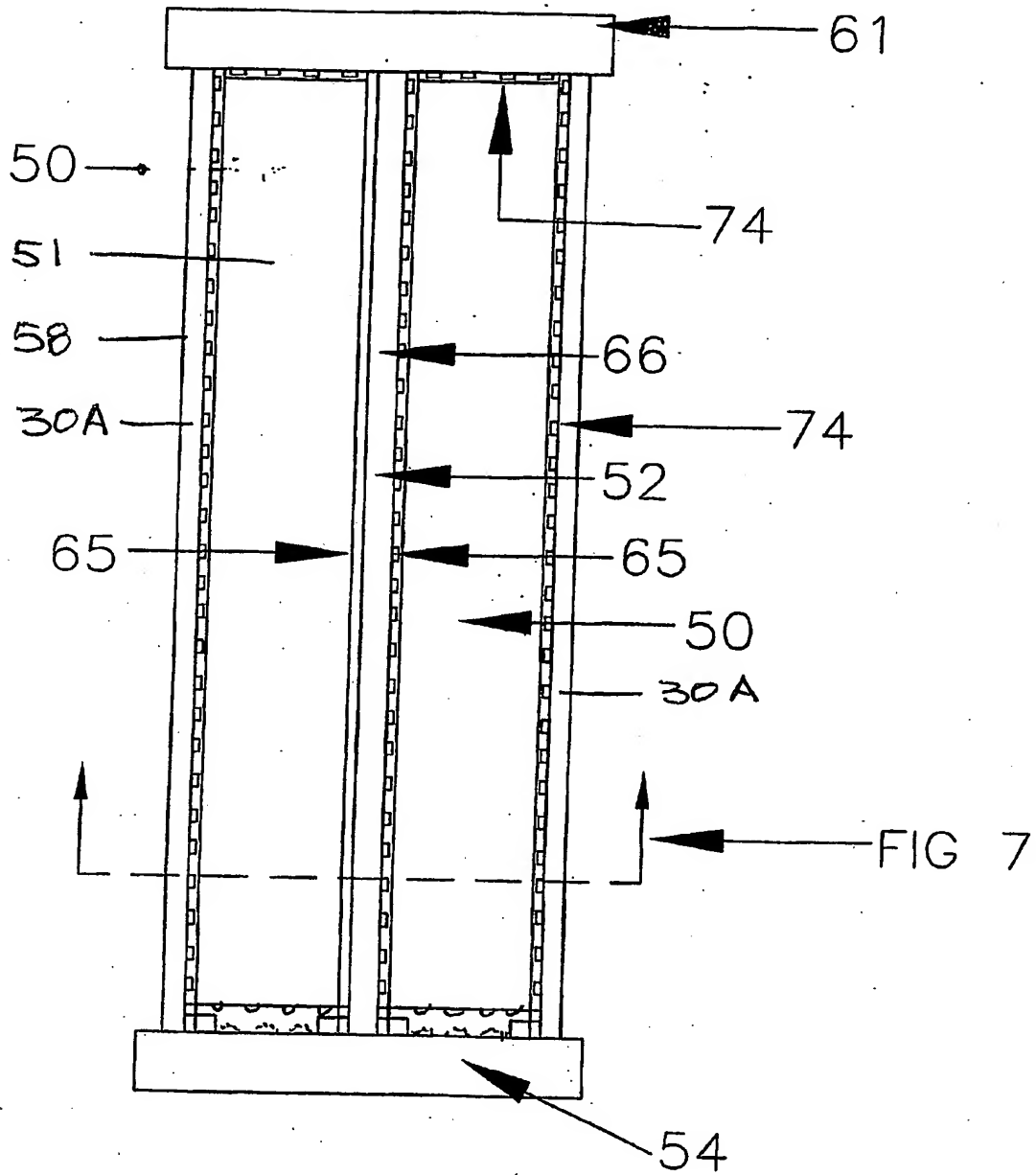


FIG. 5

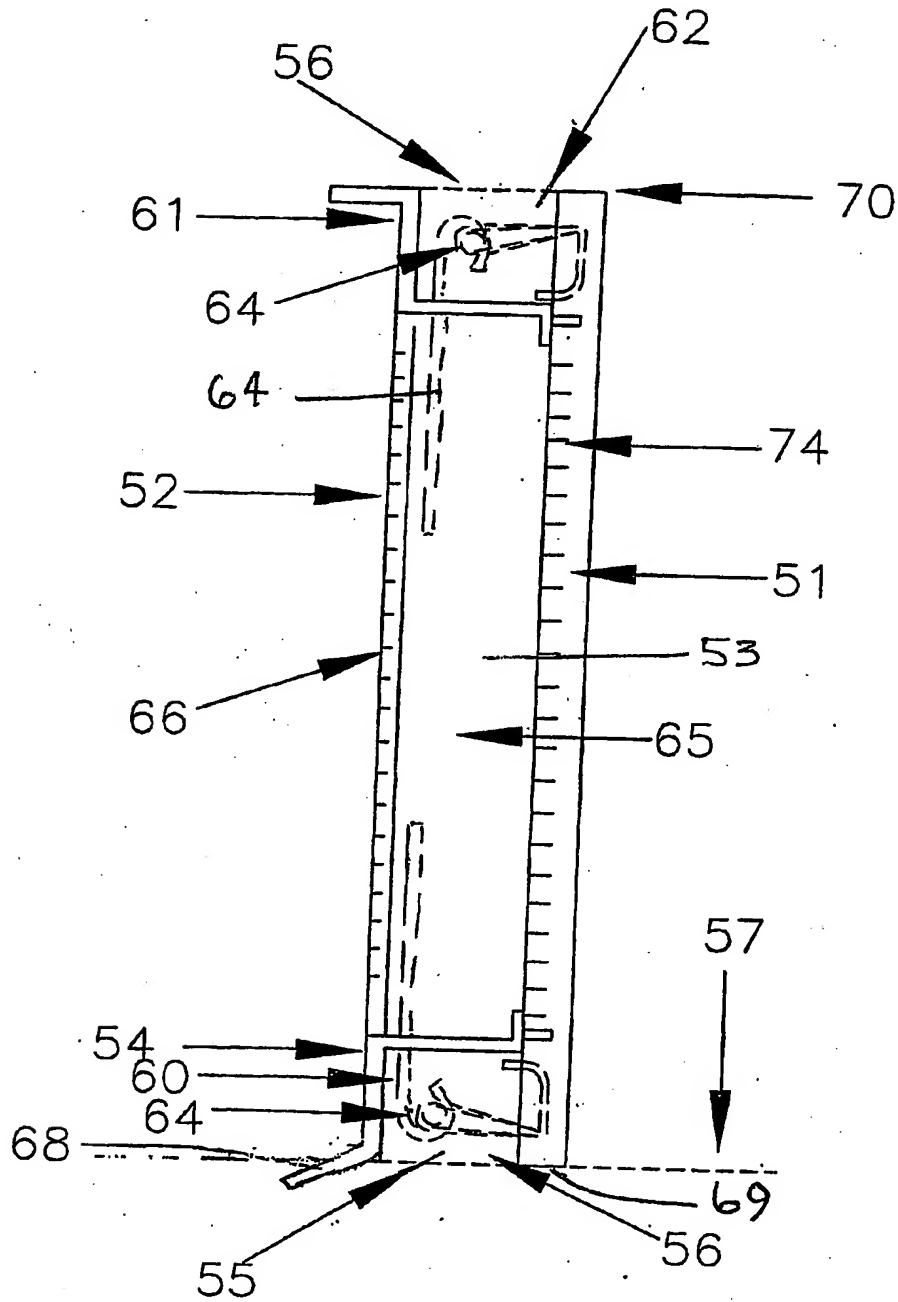


FIG. 6

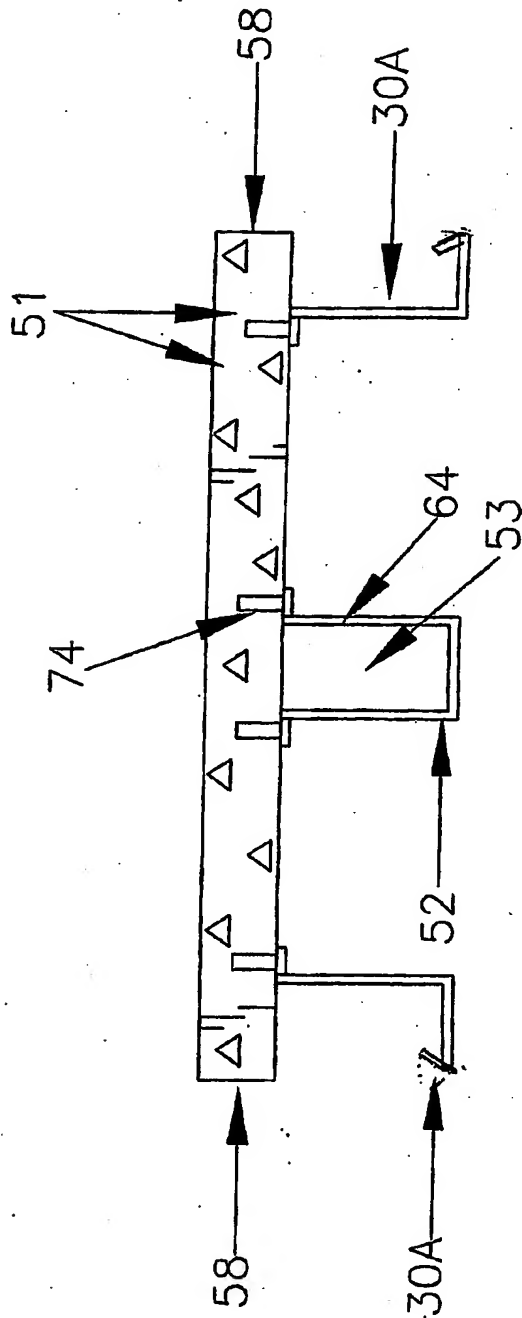


FIG. 7

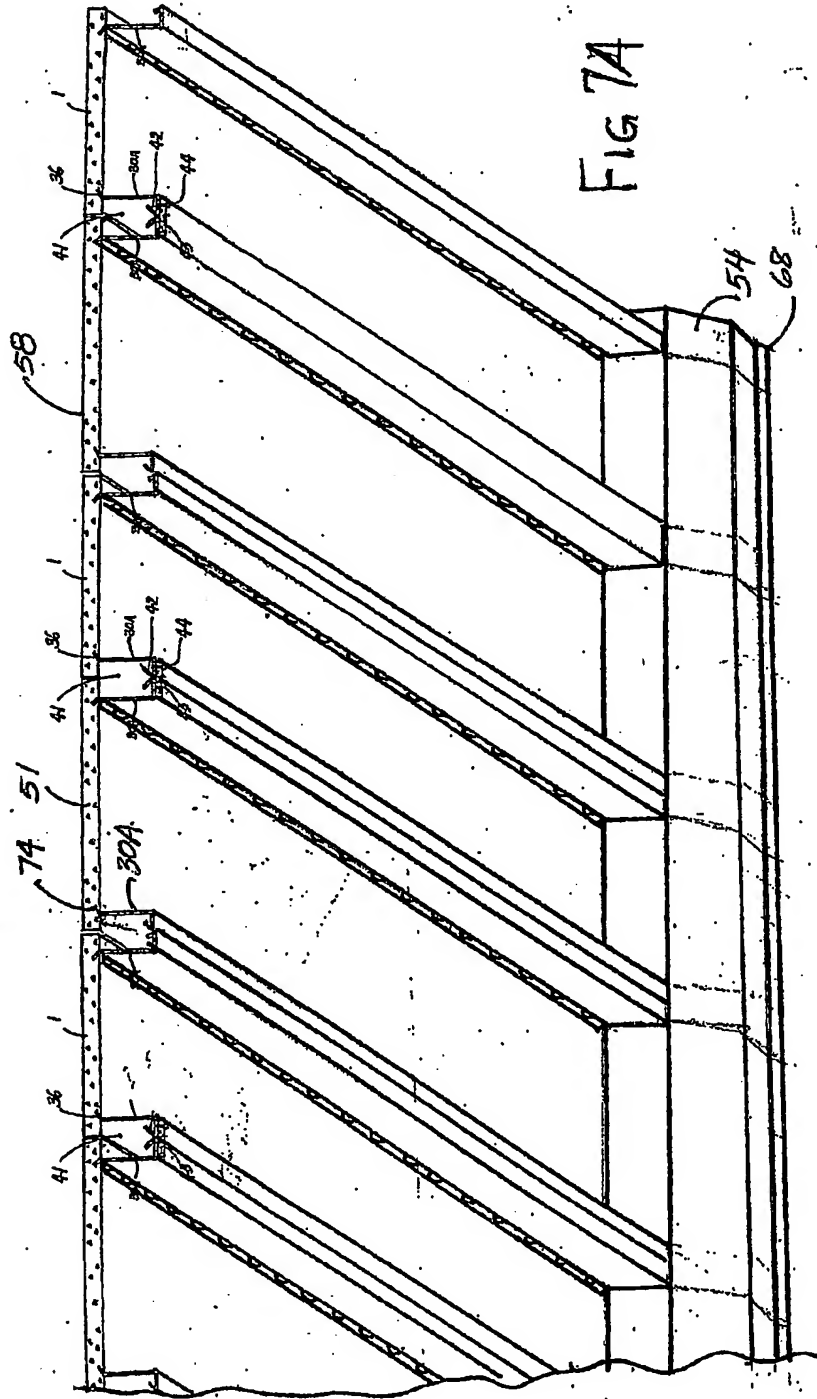


FIG 7A

Fig 9

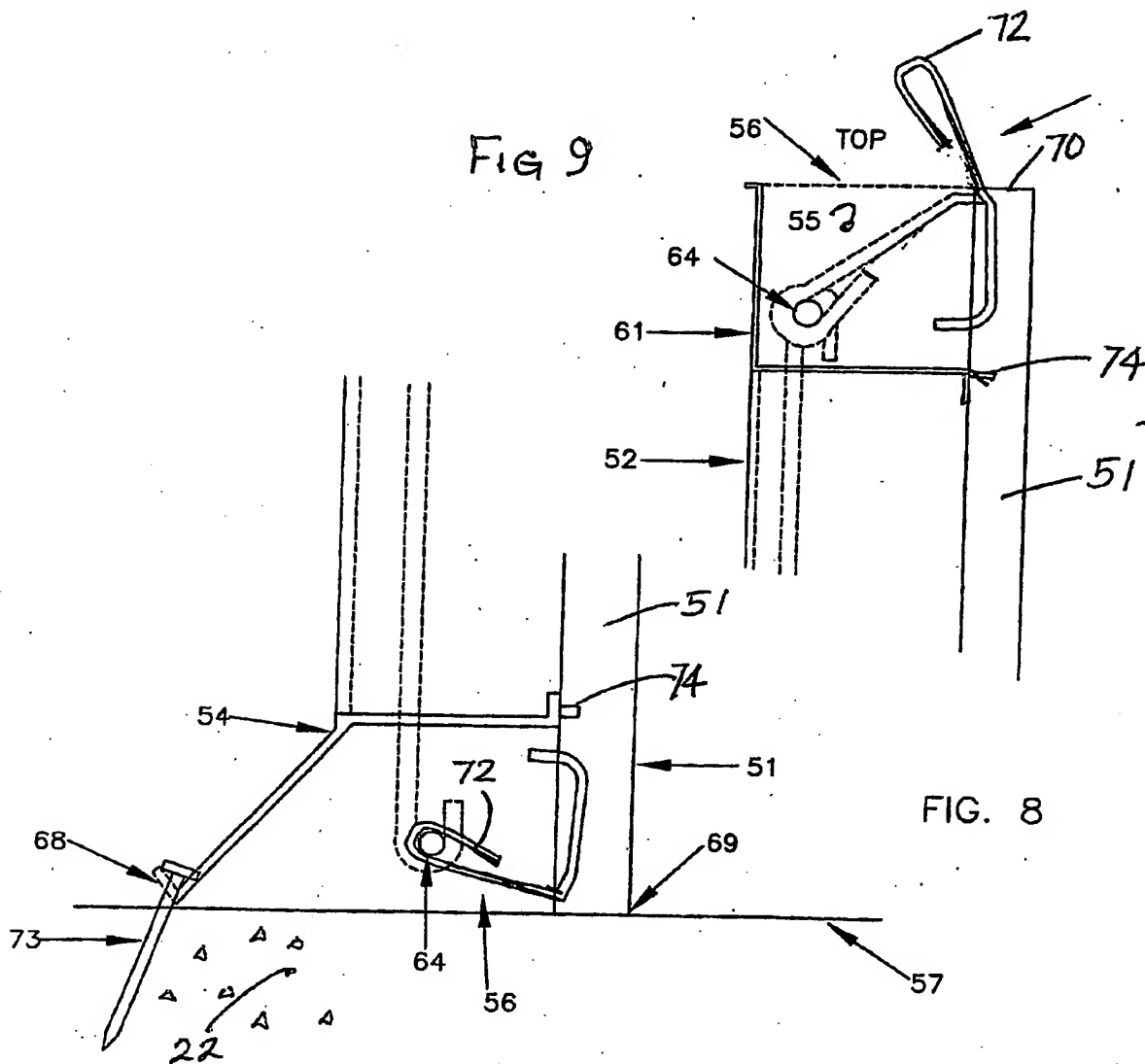


FIG. 8

